EMBO reports

The genesis of a conspiracy theory

Why do people believe in scientific conspiracy theories and how do they spread?

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In April 2017, the German television program *Plusminus* featured a documentary about an alleged new cancer therapy. It started with a suggestive question by the moderator: "What happens, when a substance promises cure but almost no profits?" and featured scientist Claudia Friesen form the University Hospital Ulm in Germany, and German physician Hans-Jörg Hilscher, who claim that methadone improves the effectiveness of anti-cancer drugs. The report portrayed methadone as a new miracle drug and conveyed the impression that the pharmaceutical industry is pulling the strings to impede its further development, because it is too cheap and would ruin their profits. The broadcast itself, and much of the media hype that followed, is a case study of how a scientific issue can turn into a conspiracy theory.

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In a *Stern TV* studio interview that followed the *Plusminus* report, moderator Steffen Hallaschka asked "Why has she still not received the Nobel Prize?" referring to Friesen. "Why is not everyone treated with methadone?" he continues and Hilscher answers by describing the medical and scientific community as a conservative enterprise that does not endorse innovative new treatments. Indeed, the interview portrays Friesen as a victim of a corrupted scientific enterprise: "Meanwhile, I don't even get my basic research funded anymore", Friesen complained. Overall, *Stern TV* and *Plusminus* make it look as if big pharma and academia have conspired against these two who stand up for the interests of patients. But even if some media reports were more balanced, the underlying problem is that once a conspiracy theory starts circulating, it is difficult to argue with reason.

Debates in science are, of course, not only common, but essential. Researchers who proposed hypotheses outside the mainstream often brought science ahead—Galileo, Einstein, Darwin, Copernicus, or Wegener are some of the best-known examples. But just having an unconventional hypothesis is not enough. You also have to be right, and you have to prove it. For the time being, the evidence regarding the efficacy of methadone in cancer treatment is inconclusive and a number of expert reports have warned against premature hopes and of potential dangers. Clinical trials are being planned, and the results will help to settle the debate.

The role of scientists and politicians

Misinformation—that can give rise to conspiracy theories—can easily spread when data are sparse. Science is a complex business, and scientific consensus is often only possible after extensive, well-conducted studies and many years of research. Usually, a scientific consensus arises once sufficient evidence has emerged. But there are exceptions, where contrarians just hang on to their beliefs and spin a conspiracy theory. There is overwhelming evidence that the MMR vaccine does not cause autism, that HIV does cause AIDS, and that global warming is caused by human activity. Nonetheless, there are deniers—and some of the most outspoken ones are scientists. In 1987, Peter Duesberg of the University of California published a paper arguing that HIV is harmless, a claim that has been echoed by AIDS deniers, most prominently Duesberg himself, ever since. Andrew Wakefield, a former gastroenterologist, has been campaigning against vaccines for 20 years. In 2016, he stirred up fears against the MMR vaccine again with his anti-vaccination propaganda movie *Vaxxed*. "Those voices are very influential and can sway people", said Karen Douglas, a social psychologist at the University of Kent (UK). "They give conspiracy theories their scientific credentials".

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Conspiracy theories can do considerable harm when they are embraced by political leaders. Former South African president Thabo Mbeki, under the influence of Duesberg, instituted policies denying anti-retroviral treatments for AIDS patients, which, according to estimates, led to the premature deaths of more than 300,000 people between 2000 and 2005. More recently, President Trump, who had repetitively expressed skepticism about global warming, announced to pull out of the Paris Agreement on climate change mitigation. "The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive", he tweeted on November 6, 2012. But why are conspiracy theories so successful? How are they born, how do they spread, and why do they persist, sometimes over decades?

Not just cranks

Some conspiracy theories are just outrageous, claiming for instance that the earth is

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flat (and that there is a conspiracy to make us think it is spherical), that the government is spraying chemicals in the air to control the population and food supply, or that lizards secretly rule the world. But to think of all conspiracy theorists as cranks is not helpful—there are just too many. For example, more than a third of the American public suspect that federal officials assisted in the 9/11 terrorist attacks or took no action to stop them, according to a Scripps Howard poll 5 years after the event. More than 50 years after the shooting of US President John F. Kennedy, 61% of Americans still think that Lee Harvey Oswald did not act it alone, but that others were involved in the murder.

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"There is an element of conspiracy theorizing in all of us and to some extent it is adaptive to be that way", Douglas said. After all, conspiracies do happen: the Watergate scandal, the Iran–Contra affair, Operation Northwoods, MKUltra, or the Tuskegee Syphilis Experiment, just to name a few. "It is good to be suspicious to a certain degree. But some people are more predisposed to that way of thinking than others, and it might not always be a healthy thing", Douglas added.

The psychology of conspiracy theorists

According to psychological research, some of the reasons we are so inclined to believe in conspiracy theories comes from flaws in the way our brain processes information. Psychologists have for a long time known that people deceive themselves through a number of cognitive biases that impede rational judgment and logical thinking—and one of them is illusory pattern perception. An important aspect of conspiracy theory is to come up with a seemingly coherent explanation that is consistent with one's worldviews. This requires seeing patterns—for instance, meaningful relationships between events—even if they are only random occurrences. In a recent paper, Douglas and colleagues argued that conspiracy theories are grounded in such illusory pattern perception [1]. They showed that people holding irrational beliefs were also more likely to perceive patterns in randomly generated coin tosses or in chaotic, unstructured paintings.

The "confirmation bias" or "myside bias" is another and related strong driver of conspiracy theories. Humans have a general tendency to embrace arguments that confirm their preexisting beliefs, while ignoring or rejecting anything that casts doubt. People who believe that vaccines or GM crops are dangerous will accept any information that confirms their fears while rejecting evidence showing they are safe as part of the conspiracy. People will eventually develop elaborate rationalizations, often devoid of any logic, to justify their beliefs and maintain a worldview that is in line with their attitudes and ideologies. "Once conspiracy has taken root it is difficult to get rid of it and one of the reasons might be that people a lot of the time believe what they want to believe", Douglas explained.

It seems counterintuitive that evolution would give us brains that impede us from generating reliable judgments. But according to the argumentative theory of reasoning by Hugo Mercier and Dan Sperber [2], cognitive scientists at the French National Center for Scientific Research, a myside bias can be explained by the fact that our brain has evolved in an interactive context. "The myside bias is quite detrimental when you are reasoning on your own, but it becomes adaptive when you are reasoning with others", Mercier commented.

When we argue with others, Mercier explained, reasoning serves two main purposes. "We argue to justify our beliefs, and to evaluate other people's justifications" he said. It thus makes sense to have a myside bias for finding justifications for one's own point of view. And indeed, according to a recent study by Mercier, we are much better at seeing the flaws in the arguments of others than in our own arguments [3]. If we are open-minded though, a good discussion will produce reliable results. "In any discussion, the initial arguments are rather weak, but they become more refined as the discussion evolves. Reasoning on your own doesn't get you very far, because you don't know the arguments of others", Mercier explained.

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Science, in many ways, makes the best of argumentative reasoning. First, scientists discuss their results with each other. But whereas scientists are of course prone to confirmation bias just like everyone else, they do seem comparably good at refining their arguments even when they think on their own. According to Mercier, this has to do with the fact that science has established standards how experiment should be done, and what kinds of arguments are acceptable. "When you are a scientist thinking about your domain of expertise, you can easily anticipate other peoples' criticism, thereby increasing the quality of your own arguments", he said. "It's not like talking politics with someone you don't know".

Simplified world views

However, irrational thinking may get the better of scientists too, particularly when they deviate from their area of expertise. "If you are a very successful scientist you may have come to think you are smarter that everybody", Mercier said. Indeed, a number of accomplished scientists developed strange ideas in their later years and became uncritical toward their own reasoning. The fact that many Nobel laureates are among them has led to the term "Nobel disease". Linus Pauling, for example, was a forerunner of the idea that megadoses of vitamin C can cure almost anything; Karry Mullis denies global warming as well as the fact that that HIV causes AIDS; Brian Josephson and Luc Montagner believe in water memory. The shortest turnover between being awarded the Nobel Prize and developing pseudoscientific ideas is held by Nikolaas Tinbergen, who presented his controversial theories about autism already in his Nobel lecture.

Faulty reasoning is only one reason behind conspiracy theories. Another one is the basic

human need for being safe and in control. "Research suggests that people gravitate towards conspiracy theories when they feel disenfranchised and powerless", Douglas commented. In the face of uncertainty, conspiracy theories give simple and internally consistent explanations that meet people's desire for predictability and definite conclusions. "You can regain a little bit of a sense of power and a sense of control over what is happening to you because you can explain those events", Douglas explained. "People feel they are in possession of this very scarce information that other people don't have. Sharing this information will make them feel more in control and more powerful".

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Science, on the other hand, is often too complex and does not provide quick and simple explanations. "One problem with science is the inherent uncertainty that goes with it. This might make it unsatisfying to the public", said Bastiaan Rutjens, a psychologist at the University of Amsterdam. Science is a slow process: Studies need to be re-evaluated, results need to be discussed, models defined, which involves a lot of back and fro and contradictory information before a consensus is reached. "If you have a need for certainty then science generally is not going to help. Maybe in general, conspiracy theories win over science in their ability to simplify the world", Rutjens said.

The single-study fallacy

Yet, while science is slow at reaching a consensus, this is not how it is presented to the public—causing even more confusion. "Many members of the public are not aware of the complexity of the scientific process", Rutjens commented. The public learns about science mainly from the media, who will report on a study that raises hopes for a new cure, or points to possible new health risks. However, the need for breaking news means that journalists often do not check the quality and reliability of the study and frame it in a "scientists have shown" format. "When people learn about the results of an experiment, they think it's a done deal, it's a fact. They are not aware of the fact that a single experiment doesn't tell you that much", Mercier said.

In fact, this "single-study fallacy", as Seth Kalichman calls it in his book *Denying AIDS*, is often exploited by conspiracy theorists. In 1998, Andrew Wakefield claimed that the MMR vaccine causes autism, based on a single study with 12 children. In 2012, Gilles-Eric Séralini made headlines claiming that Roundup-tolerant genetically modified maize causes cancer, based on feeding experiments with a few rats. Many people were convinced that, since it was a scientific study, the results were true. Both studies were eventually retracted, but the damage had been done already.

In another version of the single-study fallacy, conspiracy theorists take the absence of a single study that proves every aspect of a hypothesis as an argument that the hypothesis is wrong. In his foreword to Duesberg's book *Inventing the AIDS Virus*, Nobel laureate and AIDS denialist Kary Mullis describes how he asked many scientists for the reference showing that HIV causes AIDS. No one could name it, so he concluded that "[t]here is simply no scientific evidence demonstrating that this is true". As Kalichman points out, countless studies taken together support the conclusion that HIV does cause AIDS—but there is no single study that proves it.

Us versus them

Often, conspiracy theories involve large corporations, which, given that their goal is to make a profit, are an attractive target. The food industry is often accused of downplaying the potential risks of food products. The pharmaceutical industry, likewise, is suspected of hiding studies that their drugs do not work, or of preventing the development of cheap cures so as to sell expensive ones. Admittedly, there are examples where greed has led companies to questionable practices. But this does not mean that they will do so whenever there is a motive. The science behind vaccination, GMOs, or viral infections is difficult to understand for the lay public. Alleging that the pharma or food industry deceives the public is much easier. The higher the apparent motive behind an alleged conspiracy, the more likely people are to believe in the theory.

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Conspiracy theories do not stop at accusing "big pharma" of misconduct, but they also claim that governmental institutions, scientific associations, and academia are involved. Assertions often include the notion that powerful industries put pressure on scientists in academia to cover up "the truth". "Some conspiracy believers view the entire scientific enterprise as a conspiracy in itself. They view scientists as being corrupted by big pharma and as being part of the conspiracy", Rutjens said.

Conspiracy theorists like Wakefield, Duesberg, or Séralini like to present themselves as saviors of the world against the evil conglomerate of companies, politicians, and corrupted scientists. Wakefield, for example, who has been campaigning against the MMR vaccine for 20 years, frames his crusade as a battle for the interest of the patients. In a new documentary about Wakefield, *The Pathological Optimist*, he likens himself to the South African revolutionary Nelson Mandela. One aspect that makes conspiracy theories so persuasive is painting a picture of "us" against "them".

Scientists who turned to conspiracy theories use the same narrative, depicting themselves as mavericks fighting against a conformist academia clinging to their mainstream views. In his book *Inventing the AIDS Virus*, Duesberg gives a detailed description of what he thinks of academic science and how career and financial pressure have made it that way. Academic scientists "cannot afford a nonconformist, or unpredictable, thinker because every new, alternative hypothesis is a potential threat to their own line of research", he writes. "Few scientists are any longer willing to question, even privately, the consensus views in any field whatsoever".

Trust in science

At the core of conspiracy theories is a mistrust in authorities, the government, the

media, professional associations, institutions, industry, and academia. The scientific community has often been worrying about the general public trust in science. According to polls by the US Pew Research Center in 2016, this worry is at least partly unnecessary —science still outperforms most other institutions. However, there are certain topics about which the public holds more skeptical views, such as vaccination, climate change, or GMOs. Many people are not aware of the fact that these issues are well understood and that there is a strong scientific consensus. For example, only 42% of US American adults think that more than half of the scientists agree that GM foods are safe to eat [4].

Moreover, vaccination and genetic modification are sensitive topics, as they touch upon peoples' moral values about purity and naturalness. As scientists often work in areas with ethical implications, be it neural enhancement, climate change, reproductive technologies, artificial intelligence, or nuclear power, public expectations in their morality are exceptionally high. "People like to have trustworthy people to do research on these important topics", Rutjens explained. "They are extremely sensitive to scientific evidence that goes against their moral attitudes". According to him, "science is often idealized as the pursuit of knowledge in its [purest] form" [5]; scientists should pursue research only to advance knowledge, free of any personal gain, bias, or convictions. However, this picture builds expectations that are impossible to meet, which creates a danger that the people may become disappointed when they realize that science does not live up to the expected.

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Thus, one possible way to counter conspiracy theories may be building more trust in science by giving the public a more realistic picture of it. As Mercier put it: "You would want the public to understand that science is not 100% objective and that each individual scientist can be biased just like every other human being—but, on the whole, the process is very efficient". Scientists do not always agree, which means that they are seriously committed to finding a consensus.

References

1. van Prooijen JW, Douglas KM, De Inocencio C (2017) Connecting the dots: illusory pattern perception predicts belief in conspiracies and the supernatural. *Eur J Soc Psychol* https://doi.org/10.1002/ejsp.2331
2. Mercier H, Sperber D (2017) The enigma of reason: a new theory of human understanding. Allen Lane, ISBN-10: 1846145570
3. Trouche E, Johansson P, Hall L, Mercier H (2016) The selective laziness of reasoning. *Cogn Sci* 40: 2122 – 2136
4. Funk C (2017) Real numbers: mixed messages about public trust in science. *Issues Sci Technol* 34
5. Rutjens BT, Heine SJ, Sutton RM, van Harreveld F (2018) Attitudes towards science. *Adv Exp Soc Psychol* 57: 125 – 165

